PRECONSTRUCTION PAGES

A Publication of the LADOTD Preconstruction Project Development Division Volume 2, 1

Evaluating a Bridge's Girder Strength: No Small Order of Research!

By: Paul Fossier, Bridge Design

The Louisiana Transportation Research Center (LTRC), in cooperation with the Tulane Department of Civil and Environmental Engineering and the LADOTD Bridge Design Section, is conducting a research program to evaluate high performance concrete (HPC) bridge girders for fatigue and shear loading.

Each girder is 96 feet long, 72 inches deep Bulb Tees (BT) and has been prestressed with design concrete strengths of 7,000 pounds per square inch (PSI) at release of strands and 10,000 PSI at 56 days. The girders were designed by the bridge design section based on a 44-foot clearance for roadways, a 13-and-a-half foot girder spacing and an eight-inch cast-in-place concrete deck.

One girder was designed using the 1996 AASHTO Standard Specifications for Highway Bridges and the other two were designed using the new AASHTO Load and Resistance Factor Design (LRFD) bridge code. Shear reinforcement used either standard individual bar stirrups at one end and/or welded wire reinforcements at the opposite end.

All three girders were fabricated in July, 2000 by Gulf Coast Prestress, Inc. in Pass Christian, Mississippi. Next, they were transported to Construction Technology Laboratories (CTL), Inc. in Skokie, Illinois for a full-scale girder test. A cast-in-place concrete deck was cast in the lab to simulate the actual bridge deck during testing.

Instrumentation was placed in all three girders during fabrication at Gulf Coast Prestress, Inc., for measuring strand forces, concrete strains, shear reinforcement strains and girder camber.

Testing results, available in the near future, will enable LTRC and the bridge design section to further evaluate the use of HPC bridges in the state.

Fatigue testing was performed first for each girder by applying simulated live loads using hydraulic actuators for a maximum of 5 million cycles. After each fatigue test was completed, each girder was cut in half and both ends were tested to evaluate static shear strength performance.

The Rigolets Pass Bridge on US 90, the Union Pacific Railroad Overpass on US 165 and the I-10 overpass at LA 27 are three upcoming bridge replacement projects scheduled to use high performance concrete in their respective projects.

Bridge girders, made of high performance concrete (HPC), are thoroughly tested at Construction Technology Laboratories, Inc. in Skokie, Illinois

DOTD Enhancement Program now part of the Preconstruction Section

By: Ann Wills, Road Design

LADOTD's Enhancement Program is now a part of the Preconstruction Section, with Ann Wills replacing Bill Jack as the program manager. There are two qualified persons working full time with Wills, Valerie Horton and Steve Meek.

The enhancement program is a sub-program of the Surface Transportation Program, and was first offered under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). ISTEA offered states new flexibility in the type of project that could be federally funded by making monies available to certain nontraditional but transportation related activities. Ten activity categories were included.

This program has been continued under the current federal authorization bill, the Transportation Equity Act for the 21st Century (TEA-21), which became law on June 9, 1998 and ensures funding through 2003. This bill expanded the number of eligible categories to 12 as well as expanding the activities within two existing categories.

Transportation enhancements shift decision-making authority away from the federal level to the state level. In this regard, the Federal Highway Administration (FHWA) has chosen to leave the program open for interpretation within its guidelines but remains the ultimate interpretive authority for the states. Working with the FHWA, LADOTD has developed the state's program.

To be included in the enhancement program, projects must fit one of the 12 categories, must relate to surface transportation and have a governmental sponsor. Surface transportation is defined by the program to include water but excludes aviation as long as the proposed enhancement otherwise meets the basic eligibility criteria.

Sponsors are responsible for providing up to 20 percent of the total eligible costs of the project. Two match options are available 80 percent federal/20 percent local or 95 percent federal/5 percent local.

Projects with no obvious engineering design, only involve right-of-way acquisition or where the sponsor wants to be reimbursed for the engineering costs related to the project must be funded on an 80/20 basis.

Projects where the sponsor agrees to pay for all engineering related costs may be funded on a 95/5 basis. The advantage of this option is that the sponsor will not need to go through the DOTD consultant selection process, and design on the project may begin immediately after selection into the enhancement program.

Eligible costs for an 80/20 match option include those associated with planning, preconstruction design services, construction, supervision, inspection and testing. These services may be provided by planners, engineers, architects, landscape architects or other related professionals. They may also be provided by the sponsor's staff or by consultants. However, the sponsor must go through the DOTD consultant selection process and be authorized to proceed before design may begin.

Even though one of LADOTD's objectives is to make the program open to any interested person or group, the project must have a governmental sponsor.

Because of the program's popularity, there is not enough funding to match the applications. Projects are approved each year, and activities that add value to transportation systems, communities and rural areas throughout the country continue to become a reality, thanks to the enhancement program.

More details of the program can be found on the DOTD web page, www.dotd.state.la.us and in the Transportation Enhancement Information Guide, which is available on the web and by request.

A Message From: Robert E. Boagni, P.E.

Project Development Division Chief

It is a pleasure to present the second edition of "Preconstruction Pages," a publication of the LADOTD Preconstruction Project Development Division.

Our first newsletter was distributed to hundreds of readers, internal and external to the department. I would like to personally thank all the readers, and most of all, those who took the time to give remarks.

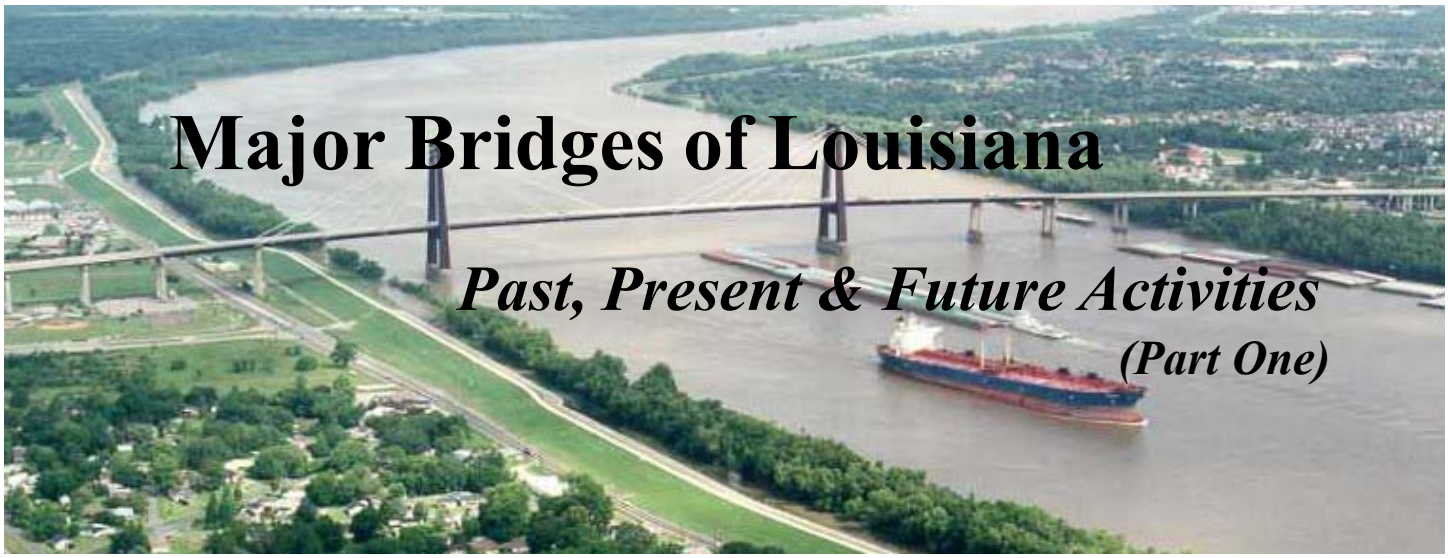
In this volume, we highlight some of the outstanding activities within the preconstruction realm at LA DOTD. Last fiscal year, we delivered plans, specifications and construction proposals to obligate over $620 million in construction contracts. This amount was a record high in the letting of construction projects.

However, available funding for this fiscal year, on both the federal and state level, will confine our letting to nearly $528 million.

One of the more outstanding LA DOTD activities this year was the procurement of a consultant group to manage, schedule, oversee, acquire right-of-way and inspect the construction of the remaining projects within the TIMED program. This selection has been a great undertaking of the LA DOTD administration, the Project Development Division and the consultant community. For more on this subject, you may read the article titled " LADOTD retains consultants for Mngt. of TIMED Program" (see page 8).

It is my desire that with varied topics, like advancements in land surveying, LADOTD's advancements in the area of high performance concrete (HPC), development of the Enhancement Program, and the design and construction of major bridges (to name a few), we will better inform our customers and employees of the many contributions made by our section.

Furthermore, new ideas and suggestions are encouraged regarding this newsletter and future publications.



Major Bridges of Louisiana

Past, Present & Future Activities

(Part One)

By: Tony Ducote, Bridge Design

This article is the first in a series of three aimed at giving a brief overview of the major bridges, existing and proposed, in Louisiana. The structures delineated in this piece will include 16 significant bridges constructed within the last 20 years. I choose 20 years (+/-) because this approximates my entire career in bridge design. The second part of this series will talk about the noteworthy structures under construction, as well as those in the design phase. Thirdly, we will focus on the interesting aspects of proposed major bridge projects in the planning and / or environmental stages.

With the many complex bridges crossing waterways in Louisiana, it is not unusual for structures of this magnitude - which demand the most sophisticated funding strategies, planning, design, and construction - to require 10-20 years for completion. Hence, one could look at this entire register as a 40 year snapshot peering into the planning, design and construction of the most prominent and complex bridges in Louisiana.

MISSISSIPPI RIVER BRIDGE AT LULING

Ultimately incorporated into I-310, this magnificent bridge connects the towns of Luling and Destrehan and was the first high-level, long-span, cable-stayed bridge built in the U.S. and the third longest in the world with a main span length of 1,222 feet. This bridge was the first of its kind to be designed to withstand hurricane force winds of up to 200 miles per hour. Modjeski and Masters designed the substructure, with Frankland and Lienhard designing the superstructure. Four construction contracts were work-ordered to Altas Construction Co., Massman and Al Johnson Joint Venture, Williams Brothers, and Boh Brothers Construction for the north approaches, substructure, superstructure, and south approaches respectively for a total of $117.1 million in federal interstate and state matching funds. The bridge, officially named *The Hale Boggs Bridge*, was opened to traffic in 1983 and received the Outstanding Civil Engineering Achievement Award in 1984 by the America Society of Civil Engineers. The bridge replaced an operating ferry which was involved in a collision with a freigher killing 78 persons in 1976. It is the fourth in a series of 12 Mississippi River crossings in Louisiana and is 121.7 miles (river mile 121.7)from the mouth of river.

ALGIERS CUTOFF CANAL BRIDGE

This high-level fixed bridge is located on the Orleans/Plaquemines Parish line on LA 407. It provides 100 foot of vertical and 250 foot of horizontal clearance over the Intracoastal Canal with a 750-foot three-span continuous steel plate girder system. The approaches are precast prestressed concrete (PPC) girders supported on reinforced concrete column bents. Although the four-lane superstructure shares a common substructure, the left and right roadway spans are independent of each other and each of their profiles are blended into a common vertical geometry in full superelevation to facilitate constructability problems with the fill heights at the abutments. The bridge main spans and approaches were designed by LADOTD, and the construction contracts were executed separately by Key Constructors and Johnson Brothers Construction Co. respectively. Federal bridge funds with state matching funds were used to replace an obsolete vertical lift truss span structure with this impressive high-rise bridge. The total cost was $20.8 million and it was completed in 1985. It is with extreme pride that I identify the approaches to this project as my first major assignment in my bridge design career, in 1981.

RED RIVER BRIDGE AT BOYCE

This aesthetic structure is located in a rural setting on LA 8 near the town of Boyce and represents the first post-tensioned segmental concrete box girder bridge built in the state. Figg and Muller Engineers designed the 1,795-foot continuous cast-in-place unit which consists of six haunched spans across the river including a navigation span totaling 370 feet. The continuous concrete girder spans on the

(SEE BRIDGES, page 4)

(BRIDGES, continued from page 3)
approaches were designed by LA DOTD. The bridge was completed in 1985 under a construction contract with J. A. Jones Construction Co. The cost was $12.3 million and was composed of federal bridge and state matching funds. This two-lane structure replaced a steel truss swing span, which had steel through truss approaches.

WEST BANK EXPRESSWAY/ HARVEY CANAL BRIDGES

The West Bank Expressway, also known as Business Route U.S. 90, parallels the Mississippi River for approximately 10 miles between US 90 on the west and the Greater New Orleans Mississippi River Bridge on the east. During the 1980's, this expressway was reconstructed as a six-lane controlled access freeway with 8.5 miles fully elevated, including a high level crossing of the Harvey Canal. Aesthetics played a major role in the planning and design of this distinctive corridor. The twin Harvey Canal bridges have a concrete deck carried on twin, five-span continuous, varying-depth welded steel trapezoidal box girders. The five-span units each have a total length of 1,223 feet and were built by Southern Pacific Transportation Co. The remainder of the elevated structures feature concrete decks on precast, prestressed, trapezoidal concrete box (Tub) girders. This was a very early introduction to high strength concrete (HSC) by the department with design strengths of 8,000 PSI (28 day) for the girders. Almost every segment was built by Boh Brothers Construction Co. HNTB Corporation designed the high level Harvey Canal Bridges, preliminary plans for the entire expressway, final plans for one of the lower level contract sections and provided overall project management. This project was built entirely with state funds at an approximate cost of $365 million.

RED RIVER BRIDGE AT ALEXANDRIA (JACKSON ST.)

Located on US 165B in downtown Alexandria, this steel vertical-lift bridge was completed in 1985 at a cost of $10.4 million in federal and state matching dollars. The presence of unusually hard (Wilcox) clay at the location of the main piers eliminated the need for a conventional concrete seal in the cofferdams. In fact, removing the material in order to construct the footings posed quite a challenge for Jensen Construction Co., the contractor. Palmer and Baker Engineers designed the project. The 300-foot main lift truss span bridge carries two traffic lanes over the Red River. It replaced the very old Murray Street Bridge, which was a steel truss swing span and had been closed to traffic due to deterioration.

MISSISSIPPI RIVER BRIDGE AT NATCHEZ/VIDALIA

Connecting the cities of Natchez, Mississippi with Vidalia, Louisiana, this site has two parallel bridges on US 84 / US 65. The newer of the two bridges was completed in 1988 by Traylor Brothers Construction Co., some 48 years after the first crossing was built. The span arrangements for the steel cantilevered through truss match that of its older companion structure. Its main spans have a total length of 3,667 feet and the trusses are made of welded "I" members as opposed to the riveted steel boxes of the older structure. The bridge, designed by HNTB of Baton Rouge, accommodates the two travel lanes in the eastbound direction. Both bridges are maintained by the Mississippi Department of Transportation, sharing expenses with LA DOTD. The newer bridge was built with federal and state matching funds at a cost of $43.6 million. It is the ninth in a series of 12 Mississippi River crossings and is located at river mile 363.3.

CRESCENT CITY CONNECTION NO. 2

Known early on as Greater New Orleans Bridge No. 2 (GNO 2), this magnificent structure parallels its predecessor, Crescent City Connection No. 1, in downtown New Orleans and was completed in 1989, a full 32 years after the first bridge. The main bridge is a 3,019-foot, steel cantilever through truss with a very impressive center suspended span of 1,575 feet and flanking spans of 853 feet and 591 feet on the East and West Banks respectively. It carries US 90B Westbound over the Mighty Mississippi with six traffic lanes and a total roadway width of 94 feet. The main river-crossing substructure was designed by Modjeski and Masters and constructed by Massman/ T.L. James/ Al Johnson Construction Companies (a joint venture). The main river-crossing superstructure was also designed by Modjeski and Masters and constructed by Harris Structural Steel

Seminar: Minimum Standards for Property Surveys

By: T.W. Parish, Location & Survey

Last December, LA DOTD's Location and Survey section sponsored a seminar on "Minimum Standards for Property Boundary Surveys" at the District 08 training facility in Alexandria.

The program was presented at the request of several district administrators and Gordon Nelson, assistant secretary.

The seminar featured an audience-panel presentation where everyone viewed a copy of the latest "Minimum Standards" and the moderator discussed conduct and requirements before answering questions. Plans are to have at least one member of the LAPELS Board, a representative of the Louisiana Society of Professional Surveyors and a representative of both the public and private surveying sectors on the panel.

All licensed surveyors employed by LA DOTD were invited to attend along with all interested consultants.

Professional development hours were awarded to all attendees in accordance with the LAPELS Board requirements.

For members of the Location and Survey section, It's just another example of *constantly improving to keep Louisiana moving*.

Company. These two contracts totaled $123.7 million and were a critical link in the reconstruction of this corridor. When added onto the massive reconstruction work on the east bank and west bank approaches to the bridge, the costs totaled over $600 million, funded primarily from state bonds. This is the first bridge seen by freighters traveling up the river from the Gulf of Mexico and is located at river mile 95.7.

RED RIVER BRIDGE AT COUSHATTA

Located on US 84 in Coushatta, the main spans of this bridge are steel-plate girders, which incidentally, were the last fracture-critical (non-redundant) main-girder structural system built in Louisiana. An extensive structural analysis went into the design of the cross frames to assist in mitigating the lack of redundancy in the primary load members. It was completed in 1990 for only $10.5 million with federal bridge and state matching funds. This structure replaced an old riveted-through-truss, which was 20 feet wide and had been built in the early 1930's. It had a total length of 1,723 feet, including a 320-foot swing span. The designers of the new bridge were Demopulos and Ferguson and T. Y. Lin International and the contractors were Jensen Construction and Rosiek Construction Companies for the approaches and main spans, respectively.

DANZIGER BRIDGE OVER INNER HARBOR NAV. CANAL

This impressive vertical lift bridge carries seven lanes of traffic over the Inner Harbor Navigational Canal (IHNC) on US 90. At 108 feet wide and 320 feet long, the main lift span is almost as large as a football field. Upon completion in 1991, it was the worlds widest vertical lift bridge. The movable span was designed with steel box girders and an orthotropic deck. Landis Construction Co. and Williams Brothers built the bridge sub and superstructures, respectively, at a total cost of $37.9 million. The funds were federal bridge and state matching dollars. Sverdrup Corp. designed the structure. The new bridge replaced a double-leaf bascule bridge that opened more than 20 times a day and was frequently struck by marine vessels. After completion, the new structure was awarded the Prize Bridge - Movable Span by the American Institute of Steel Construction.

I-310 BRIDGE (I-10 TO US 61 END-ON)

Although the impressive I-310 interchanges at I-10 and at Airline Highway (US 61) represent excellent engineering projects, the emphasis here is the 1.8-mile segment of I-310 built between these two interchanges. This section was constructed utilizing the "end on" or "top down" technique. This unconventional construction method was used because no heavy equipment was allowed on the ground throughout these environmentally-sensitive protected wetlands, known as prime tupelo/cypress swamp. The cleared trees in the direct path of the bridges were not removed but left where they fell for fear that removing them would cause further damage. Working from platforms attached to driven piles, cranes erected precast pile caps and spans transported in on the adjacent structure. As more piles were driven, work platforms were constructed, caps and spans were erected behind cranes, and construction moved sequentially forward - one span at a time on twin bridges.

The plans allowed alternates for the substructure consisting of 24 and 30-inch square pilings and 36 and 54-inch cylindrical pilings, combined with three different superstructure alternates. The plans were designed by LADOTD and, after T.L. James was awarded the contract, the designs were modified due to limitations on the construction equipment reach and hence the induced load on the structural system. The contractor selected the use of 40-foot voided spans supported on 24-inch precast pilings. The cost of this project was $26.2 million, consisting of federal Interstate funds. The project, completed in early 1992, was 100 working days ahead of schedule. Key LADOTD staff members and the contractor received the 1992 Build America Award presented by Motorola and AGC of America for this combined success.

ALEXANDRIA NORTHBOUND EXPRESSWAY (RED RIVER)

This new river crossing between the Cities of Alexandria and Pineville represented the first of two structures to become part of the expressway linking US 167 to I-49. In the beginning, it was referred to as the Fulton Street Bridge, due to its alignment with that downtown street. However, technically, it is part of the Alexandria/Pineville expressway. The main spans of this three-lane bridge are of a continuous steel-plate girder design. Excellent unit cost received during bidding of the project convinced the department of the advantages of a parallel multi-girder system, in lieu of a girder / floor beam / stringer system (which was prevalent prior to this time). Ultimately designed to handle the northbound traffic lanes, the facility had to first accommodate both north and south bound traffic (four lanes) during the removal and replacement of the adjacent bridge. The bridge was designed by LADOTD, and the contractors were Jensen Construction and Johnson Brothers for the main crossing and approaches, respectively. With a total cost of $15.9 million in federal and state matching funds, the bridge was completed in 1995.

MISSISSIPI RIVER BRIDGE AT GRAMMERCY

Located on LA 3213 between Gramercy and Wallace, this steel-cantilever through truss bridge carries four traffic lanes across the river. The center span is 1,460 feet in length. The approaches to the main trusses were designed utilizing the Louisiana 66-inch-deep Bulb Tee (BT) precast prestressed concrete girder. This was the first application of this girder type, later replaced with the AASHTO 72-inch-deep BT. The bridge was completed in 1995 after 14 years and a series of five construction contracts to build the substructure. The substructure, superstructure, as well as both approaches, cost $109.6 million in state capital outlay funds. The contractors were T.L. James, Traylor Brothers, SLC Division of Sorrento Lumber Co. and Williams Brothers. The designer of the bridge was E. Lionel Pavlo Engineering Co. The official name of the bridge is *The Veterans Memorial Bridge* and it is the fifth in a series of 12 crossings of the Mississippi

(SEE BRIDGES, page 6)

(BRIDGES, continued from page 5)
River in Louisiana located at river mile 146.0.

EAST MAIN PARK BRIDGES

These twin high-level bridges in Houma are located on LA 24 and LA 659 and are part of a couplet (two lanes in each direction), which crosses the Intracoastal Waterway at its intersection with Bayou Terrebonne. The bridges replaced two low-level movable bridges. The existing bridges posed a number of serious difficulties for mariners, motorists, and LA DOTD's Maintenance and Bridge Design Sections. At this site, there were numerous difficulties with navigating a vessel through the narrow openings of the movable bridges. This resulted in frequent collisions with the bridges and fendering system. These accidents placed a severe burden on the department to provide structural evaluations and maintenance on the bridges, as well as the public having to tolerate traffic congestions and frequent bridge closures. It also placed the department, repeatedly, in a defensive posture in terms of tort liability. The new bridges are each composed of a three-span continuous steel plate girder and 66-inch concrete type BT girders for the approaches. They provide 73 feet of vertical clearance and a much needed 220-foot navigation span over the channel. The bridges were designed by Modjeski and Masters and built by Shappert Engineering Co. The cost was $19.3 million of federal bridge and state matching dollars and they were completed in late 1997.

ALEXANDRIA SOUTHBOUND EXPRESSWAY (RED RIVER)

Located in the same area as the Old Fulton Street Bridge, this structure was initiated immediately after the northbound bridge (previously discussed), was completed. It was designed for the three southbound lanes of US 167 also tying into I-49. Conceptual designs were made to modify the existing vertical lift truss bridge by raising it into a higher and fixed position and rebuilding the approaches. This concept was deemed problematic primarily due to the large number of rivets that would have needed replacing with high strength bolts as well as concerns with the remaining fatigue life in some of the members. In the end, the entire bridge was removed with the exception of the two very large caisson piers that were modified and incorporated into the new bridge. The designer of the facility was Modjeski and Masters and the contractor was Traylor Brothers. It was completed in 1998 with federal and state matching funds totaling $16.7 million.

BAYOU BOEUF BRIDGE AND APPROACHES

Located on relocated US 90 (Future I-49) between Morgan City and Amelia, this 17,800-foot long twin-structure was a "TIMED" project laid out parallel to the existing US 90. This controlled access facility also contained six elevated ramps 6,800 feet in length. The bridge was designed to maximize safety utilizing extra long acceleration lanes intended to compensate for the vertical grade. The main span consisted of a three-span continuous plate girder unit 585 feet in length, providing 73 feet of vertical clearance above the navigational waterway. The bridge approaches consisted mainly of AASHTO prestressed concrete girders. The bridge was built in some of the most difficult soil conditions in the state with piles that exceeded 190 feet in length. It was the first bridge in Louisiana to make use of Osterberg Cell test piles and steel stringer spacing exceeding 12 feet. The structure was designed by LADOTD forces and built under four separate projects. The contractors were Shappert Engineering Co., T. L. James and Johnson Brothers Corp. The bridge was completed in September 1999 for a total cost of $71 million utilizing state "TIMED" and federal highway funds.

RED RIVER BRIDGE AT MONCLA

This high-level fixed bridge is the most recently completed project and represents yet another major bridge replacement in our continuing efforts to eliminate deficient bridges. It is located in a rural area south of Alexandria on LA 107. The main river spans are continuous composite steel plate girders and the approaches are built of precast prestressed concrete and 72-inch BT girders that span 125-foot and 135-foot in length. These concrete spans were the longest built to date in the state. The main four-span continuous unit over the river has a 265-foot/360-foot/360-foot/265-foot span arrangement with impressive steel-plate girders nearly 14 feet in depth. Steel girders were also designed for the approach spans as an alternate to the concrete girders, but the bidders all selected the concrete PPC BT girders. Anticipated scouring conditions at this site dictated the design and construction of cofferdams capable of resisting over 80 feet of hydraulic head force. The bridge, which replaced a very old and narrow vertical lift-truss bridge, was opened to traffic in early 2000. It has a 44-foot clear-roadway for two travel lanes and shoulders. It was designed by LADOTD and the contractors for the main spans and approaches were Massman Construction and Coastal Bridge Co., respectively. The total cost in federal bridge and state funds was $22 million.

Be sure to keep an eye open for Part 2 in the next issue where the following bridges under construction or final design will be highlighted:

*Black River Bridge at Jonesville
*Intracoastal Coastal Waterway Bridge at Louisa
*Ouachita River Bridge at Columbia
*Rigolets Pass Bridge near Slidell
*Red River Bridge at Shreveport
*Ouachita River Bridge at Sterlington
*Red River Bridge Alexandria (Fort Buhlow)

As well as Part 3 soon thereafter to include bridges in planning and environmental studies:

*Ouachita River Bridge at Harrisonburg
*Chef Menteur Pass Bridge near Slidell
*Mississippi River Bridge near St. Francisville
*Almonaster Bridge over the IHNC
*Bayou Barataria Bridge near Lafitte
*La 1 Improvements & the Leeville Bridge over Bayou Lafouche
*Huey P. Long Bridge over the Mississippi River in N. O.
*Florida Avenue Bridge over the IHNC
*Calcasieu River Bridge in Lake Charles

WIND INDUCED VIBRATION of BRIDGE CABLES :

a national and international concern!

By: Hossein Ghara, Bridge Design

There are more than 600 cable-stayed bridges in the world and many others will be designed and constructed in the future. With more than 200 such structures in Japan and 30 in the United States, these bridges are increasingly becoming the bridge type by choice for engineers and designers. The Mississippi River Bridge at Luling-Destrehan with a main span length of 1200 feet, is currently the only cable-stayed bridge structure in Louisiana.

The cable-stayed bridge concept has gained popularity in Japan and Europe and, in the last decade, in the United States for its simplicity and economics. However, in the past 5 or 6 years, this type of cable design has been subject to some concern to the bridge designers.

Probably the most outstanding concern lies with the mechanism of wind and rain induced cable vibration. The great majority of cable-stayed structures worldwide have experienced one or more types of cable oscillation. There are about 8 reasons why cables in cable-stayed bridges vibrate, but the most common causes of vibration and/or oscillation of cables are due to rain-wind excitation or galloping of the cables due to high winds (more than 40 mph.) and galloping of cables in the wake of other structural components (towers for example).

In recent years, bridge engineers have been able to trace the cable vibration to a combined wind and rain application. The vibration of cables due to this combination usually is seen in mild rains combined with wind speeds ranging from 10 to 40 mph. This phenomenon is related to the formulation of a rivulet of rainwater along the length of the cable, which translates into a change in the cross sectional properties of the cables, creating lift and in turn abnormal behavior of the cables.

Large cable-stayed oscillation may cause unanticipated bending stresses in the anchorage zone. Bending of the cables could also result in fatigue damage to the strands. Damage to the cables or the anchorage zone can result in catastrophic collapse of the bridge. Some examples of cable-stayed bridges in our neighboring states, which have documented wind-rain induced vibration of cables are the Cochran Bridge in Mobile, Alabama and the Fred Hartman Bridge over the Houston Ship Channel in Texas. Both structures have been subjected to severe cable oscillation and galloping, resulting in potentially dangerous failures in the cable-stayed and its supporting structures.

Incidently, cable-stayed vibrations of lower magnitudes have been reported by the resident engineer and eyewitnesses at the Mississippi River Bridge near Luling, Louisiana. These vibrations are serious enough to cause failures in the cables and the anchorage. Additionally, since the cables are placed in a pipe and grouted, they cannot be visually examined for cross-sectional loss due to corrosion. The combination of these issues is reason enough to prepare for a comprehensive examination of critical parts of this bridge.

Recently, LADOTD Bridge Design requested the procurement of a nationally known engineering firm of Construction Technology Laboratories, Inc. (CTL) for the structural evaluation of this bridge. A contract for the inspection of the Luling Bridge in the critical zones has been signed and CTL will begin their work in the near future. CTL, based in Skokie, Illinois, has extensive experience with cable-stayed structures in terms of analysis and inspection. The bridge design and the bridge maintenance sections have had a number of meetings with CTL, discussing the nature of their inspections, which we think is required to insure the structural integrity of this bridge and to create a baseline for future inspections as a means of comparison.

Also, the bridge design section is currently involved in a nationally-funded study to better understand wind-rain induced vibration of cables and to formulate improved solutions to reduce the magnitude and the frequency of such occurrences.

Governing Stability Parameter

Scruton Number, Sc
known as mass Damping Parameter

$$Sc = \frac{m\&}{pD^2}$$

m = Mass per unit length of Cable
& = Damping Ratio of Cable
p = Air Density
D = Cable Outside Diameter

LADOTD Retains Consultants for Management of TIMED Program

By: Robert E. Boagni, Project Development Division Chief

In 1989, the Louisiana Legislature established the Transportation Infrastructure Model for Economic Development (TIMED program). This program was funded by a four-cent gasoline tax and was intended to connect the heavily populated centers of the state with four-lane highways. The original program consisted of 16 major projects, which included 11 highways, three major bridges, funding for the Port of New Orleans and funding for the New Orleans Intl. Airport (all with an expiration date of 2005). In 1998, state legislators extended the time limit of the tax until all of the designated projects were completed.

At current project costs and with a fixed revenue stream, it was projected that the entire TIMED program would not be completed until 2022. In lieu of a "pay-as-you-go" concept, the challenge to the LA DOTD was to determine an alternative concept that would allow for the earliest possible completion of this program. An initial evaluation indicated that selling revenue bonds supported by the four-cent gas tax could be feasible and would allow for completion of all projects in a 10-year time frame. Due to the tremendous work effort involved and to develop a comprehensive evaluation of the feasibility of bonding, it was determined that the services of a program management consultant would be retained. In response to a LA DOTD advertisement for such services, three firms responded to a scope of services that included program management, scheduling, oversight of project design, right-of-way acquisition, construction inspection and detailed financial feasibility of the entire program.

It was the conclusion of all three applicants that it was indeed financially feasible to complete all remaining TIMED projects in a 10-year timeframe and that sufficient funds would be available by bonding the dedicated revenue from the gasoline tax. After a thorough evaluation of the applicants and their proposal for this project, the joint venture of Louisiana TIMED Managers (LTM) was selected. LTM is a joint venture of Gulf Engineers and Consultants (GEC), Parsons Brinckerhoff (PB) and the LPA Group. Under the LTM proposal, all work was guaranteed to be completed in eight years at a cost of under $ 2.4 billion. LTM's contract will allow flexibility in utilizing both the department's and the consultant's manpower to produce the most cost effective product.

Efforts are underway to secure approval at the state level for the sale of bonds. Should the bonding concept prove successful, the accelerated TIMED program will provide a much-neededboost to the construction and engineering industry.

Two Fall Workshops hosted by LADOTD's CCS Section

By: Babak Naghavi, Consultant Contract Services

Last fall, LADOTD's Consultant Contract Services Section conducted two comprehensive four-hour workshops to facilitate communication with respective consultants and improve the consultant selection process. Over 200 consultants attended and viewed the assembly as a great success. The workshops, held at the Marriott Hotel in Baton Rouge, included topics like the selection and criteria process, the new 24-102 Form, submittal requirements, various contracts and an overview of the consultant performance rating process. In addition to providing positive feedback, the workshops allowed interaction between LADOTD, members of the selection committee and the consultants.

LA DOTD's Location & Survey Section Considering GPS

By: T.W. Parish, Location & Survey

The Location and Survey Section at LADOTD is currently investigating the possibility of participating in the establishment and operation of a network of Global Positioning System (GPS) receiver control stations, jointly with the US Corps of Engineers, NASA, LSU, UNO and ULL.

The preliminary plan is to locate eleven sites throughout the state of Louisiana where GPS receiver stations will be established. These sites will be precisely positioned, horizontally with reference to the Louisiana High Accuracy Regional Network, (HARN), as established in 1990 by the Location and Survey Section and the National Geodetic Survey (NGS) and vertically with reference to the North American Vertical Datum of 1988 (NAVD-88).

GPS receivers located at these sites will operate 24 hours per day, 365 days per year, receiving and storing satellite data for use in differential GPS operations by the department, the US Corps of Engineers, FEMA, and private engineers and surveyors.

Due to major budget reductions in recent years, the National Geodetic Survey has completely curtailed all of it's precise differential leveling activities and is adopting guidelines for establishing NAVD-88 heights using GPS. Conventional NGS "benchmarks" will no longer be established by NGS level crews. The precise leveling and gravity work involved in the establishment of the control network will be left up to others.

One goal of the program will be to establish a network of secondary vertical control stations, none closer together more than 10 km, and meeting 2 cm (or 95 percent) accuracy standards. Most vertical surveys which are tied into NGS control are usually performed in accordance with third-order or lower leveling procedures. The allowable error in this class of survey, performed following all of the standard specifications and procedures for third order leveling, are less than 2 cm for nominal distances.

Another positive benefit will be the densification of the existing control network in the state of Louisiana. The information will be available through these control stations for any surveyor to perform high-accuracy GPS control work on all of his surveys, which can be submitted for publication and subsequent use, thereby providing the state-wide control necessary as a basis for all future development of Geographic Information Systems and Land Information Systems.